OFFICIAL COPY.

Dr. S. W. Wheaton's Report to the Local Government Board on Enteric fever in the Ilkeston Registration Sub-district.

Richd. Thorne Thorne,
Medical Officer,
July 4th, 1899.

The Return of the Registrar-General for the fourth Quarter of the year 1897, showed that were 16 deaths from enteric fever in the Ilkeston Sub-district in that quarter, the deaths for the four preceding quarters having been six, three, five, and two, respectively. Again, the return for the fourth quarter of the year 1898, showed 25 deaths from enteric fever in the Sub-district, the deaths registered in the four preceding quarters, having been 16, 7, 1 and 4 respectively.

These facts pointed to a very heavy incidence of enteric fever on the sub-district, and I was therefore instructed to make inquiry into the circumstances with which the enteric fever had been associated. I commenced the inquiry on February 21st, 1899.

The Ilkeston Sub-district comprises the Borough of Ilkeston, the Urban District of Heanor, and the parishes of Trowell, Cossal, and Shipley; which are included in the Basford Rural District. The Basford Rural District comprises altogether 36 parishes—some of which are in the County of Derby, others in the County of Nottingham. The parishes of Trowell and Cossal are situate in the County of Nottingham, the remainder of the sub-district is in the County of Derby. The total population of the sub-district in 1891 consisted of 31,455 persons, of which 19,744 resided in the Borough of Ilkeston, 9,779 in the Urban District of Heanor, and the remaining 1,932 in the three parishes which are included in the Basford Rural District.

I.—ENTERIC FEVER IN THE BOROUGH OF ILKESTON.

(*a.*) *General Sanitary Condition of the Borough.*—The district under the control of the Town Council of Ilkeston has an area of 2,526 acres. The whole of the district is situate in the County of Derby, and is coterminous with the parish of Ilkeston. The population in 1871 consisted of 9,662 persons only, in 1881 it consisted of 14,122 persons, in 1891 of 19,744 persons; and the population in the middle of the year 1898 was estimated at 25,500 persons, living in 5,020 dwellings. Owing to the extensive opening up of collieries in the neighbourhood the population has increased rapidly of late years, and by reason of the abundant opportunities for employment there is very little poverty.

The town is grouped about one main street, two miles in length, which extends along a ridge of elevated ground from north to south. This ridge is situate between two streams, the river Erewash on the east and

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the Nutbrook on the west, the distance between the two streams being on an average one and a half miles. In addition to the dwellings which are grouped about this main street, there are a large number of dwellings situate on the slope which extends from the high ground forming the ridge eastward to the river Erewash. At the northern end of the town the village of Cotmanhay has, owing to extension of building operations, become continuous with the town. The only considerable group of detached dwellings is situate at Little Hallam Fields, where there are about 200 dwellings occupied chiefly by the workers at the Stanton Ironworks. These dwellings are about a mile and a half from the centre of the town. The rivers Erewash and the Nutbrook are almost parallel one to the other, running from north-west to south-east. About four miles to the south of Ilkeston the Nutbrook joins the Erewash, the latter river ultimately falling into the Trent. The Erewash river is accompanied by two canals, the Erewash and the Nottingham canals respectively. This river forms the boundary between the counties of Nottingham and Derby, and also for a considerable distance forms the boundary of the borough of Ilkeston. The Nutbrook is also accompanied by a canal, the Nutbrook, and for some distance forms the western boundary of the borough of Ilkeston.

The situation of the town of Ilkeston is, therefore, one which is very favourable to the free circulation of air about dwellings, to their free exposure to sunlight, and to the easy removal of liquid refuse from their neighbourhood by means of drains and sewers. The subsoil consists of clay and gravel overlying the coal measures.

The inhabitants are chiefly of the working class, and are engaged in coal mining, iron-smelting, boiler-making, and brick-making. There are also some lace factories and a needle factory which give employment to women.

Condition of Dwellings.—Dwellings are for the most part well built, and with a sufficiency of open space in the rear. A large proportion of the dwellings have been recently built. There are very few back-to-back houses, and few courts. The streets are as a rule wide, and are properly made and kept clean. Yards and open spaces in the rear of dwellings are, however, especially as regards the older dwellings, frequently unpaved, so that rain-water obtains an entry to the sub-soil, carrying with it any filth which may be thrown on the surface. The outsides of dwellings are frequently of cleaner appearance than their interiors, since many of the inhabitants are not at all cleanly in their habits, and the accumulations of dirt and rubbish in dwellings are sometimes very great.

Water Supply.—This is derived from three sources—(1) the Nut brook; (2) a disused coalpit; (3) private wells. The water from sources (1) and (2) is collected and distributed by waterworks, which are the property of the Town Council. These waterworks are situate at Kirk Hallam, and are within the borough, being situate alongside the Nutbrook, which, as has been mentioned already, is accompanied by the Nutbrook Canal. The waterworks consist of one reservoir and a pumping station for the supply of water from this reservoir to the town. The disused coal pit at Kirk Hallam, which forms the second source of supply, is situate on the western side of the Nutbrook, and is therefore outside the borough, but is only about 200 yards distant from the reservoir. The water from the Nutbrook flows directly into the reservoir, that from the coal pit is pumped into it. The reservoir is roughly constructed, without lined or pitched walls, its northern end terminating in a patch of swampy ground in which formerly a spring burst forth known as the Oak Well. This spring has recently however ceased to yield any appreciable quantity of water.

From the reservoir the water flows by gravitation into two filtering tanks. Each of these tanks is formed of brick with sloping sides. The filtering material is in the main sand obtained from the river Trent. This rests on a layer of gravel obtained from the same source, which is supported on a layer of perforated bricks placed over rows of ordinary bricks fixed edgeways on the bottom of the tank, so as to form channels for the collection of the filtered water. The sand and gravel when first placed in the filter have a total depth of six feet, but this is diminished by the subsequent scraping of the surface of the sand from time to time. The area of the upper surface of each filter bed is 241 square yards, and the water resting on the sand has a depth of 11 feet 4 inches. The filtration takes place in a downward direction, the filtered water flowing into a sump from which it is pumped into the mains for the supply of the borough. The pumping from

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this sump is continuous both day and night. The surface of the filtering bed is scraped as a rule once a month, and from one to one and a half inches of sand are removed each time in the process. I happened to visit the waterworks at a time when the surface of one of the filters was in process of being scraped. There was a thick deposit of slimy ooze on the surface, and the sand was very black and dirty for a distance of at least six inches below the surface. The material of the filters is renewed twice in the year. The supply of water to the borough is a continuous one, and there are no supply cisterns in dwellings. There are separate flushing cisterns for water-closets. Any water not absorbed whilst in circulation passes to a reservoir situate at a high level at Cotmanhay, which has a capacity of 200,000 gallons. This reservoir serves to maintain pressure during intervals of pumping.

The quantity of water has been sufficient for the needs of the borough. The quality of the water obtained from the Nutbrook, which is the main source of supply, is however of the most objectionable character.

The water standing in the reservoir and filter tanks has a very unpleasant appearance. It is greenish in colour, very turbid, and contains decaying leaves and other vegetable debris.

The water of the Nutbrook is derived from the Stanley Brook, the Mapperley Brook, and the Nutbrook Canal. These join the Nutbrook in the above order from below upwards in its course.

The Stanley Brook which is the most important feeder of the Nutbrook commences in the neighbourhood of Morley, about four miles from Ilkeston. It is there formed by surface drainage, from land which is mostly laid down in permanent pasture. Until it reaches the hamlet of Stanley Brook, which consists of twelve dwellings, the water in it has a clean and bright appearance, but at this point which is about three miles from its junction with the Nutbrook, the water in it is grossly polluted. The hamlet of Stanley Brook is situate on the banks of the stream. The midden privies pertaining to dwellings are in several instances built directly abutting on the stream. All the liquid refuse from the dwellings, and much of the contents of midden privies pass or are thrown into the stream, which also forms the receptacle for all the household refuse. About one hundred yards below the hamlet of Stanley Brook, the stream receives a large amount of foul water from a colliery.

A short distance further on it is joined by a small watercourse conveying all the liquid refuse from the hamlet of Stanley Brickyard, which consists of three rows of houses. The liquid refuse from a row of dwellings here, sixteen in number, is directed into a roughly constructed tank, the overflow from which passes into this watercourse; that from the remainder of the dwellings flows directly into the brook. This watercourse at Stanley Brickyard also receives the contents of privies, and is in such a condition, owing to accumulation of filth in it, as to be a dangerous nuisance. A few yards further on, the Stanley Brook is joined by a small watercourse which collects all the liquid refuse from the village of Stanley (population in 1891, 1,001), the drains from the dwellings here being connected directly to the watercourse. This watercourse also receives the contents of privies pertaining to neighbouring dwellings, and is in such a condition as to be a dangerous nuisance. All the before-mentioned groups of dwellings are situate in the Shardlow Rural District. From this point, the Stanley Brook runs mainly through fields to join the Nutbrook half a mile above the waterwork's intake. Before joining the Nutbrook, it receives a quantity of water pumped from outside the casing of the shaft of a coal-pit at West Hallam.

The Mapperley Brook falls into the Nutbrook about a mile above the point at which the Stanley Brook joins it. The Mapperley Brook collects the surface drainage of land in the parish of Mapperley, which is situate in the Belper Rural District, but a large portion of the water in it is derived from collieries. Its main feeder commences in a pond situate on waste ground near Mapperley Park Colliery. The contents of middens and a large amount of refuse are thrown into and around this pond. Shortly after leaving the pond the stream receives the liquid refuse from a few dwellings, and at the point where it crosses the road leading from West Hallam to Mapperley the water in it has a very foul appearance. From this point it flows through a pond in the neighbourhood of West Hallam Colliery before falling into the Nutbrook.

The Nutbrook commences at a point about half a mile above the junction of the Mapperley Brook with it. At this point it is formed by overflow water from the terminal basin of the Nutbrook Canal. The water flows continuously over a weir from the canal to the brook. The water of the canal is wholly supplied by the overflow from two large artificial ponds situate in the parish of Shipley. The water of these ponds is furnished mainly by two streams. The first stream commencing near the town of Heanor receives the effluent from the Heanor sewage farm situate at Common Side, also the liquid refuse from a number of dwellings, and falls into the uppermost of the two ponds feeding the canal. The sewage on this sewage farm can hardly be said to be "treated" in any way since it merely flows through a few surface channels on grass land before falling into the brook. On escaping from the first pond the stream is joined by the second, which commences at Marlpole in the Heanor Urban District, and which receives the unpurified liquid refuse from a number of dwellings there. Somewhat lower down, before falling into the lowermost pond, the stream receives the effluent from coal filters which deal with the sewage from dwellings pertaining to Woodside Colliery. This effluent at the time of my visit appeared perfectly clear and caused no deposit in the brook. Below this point the stream formed by the union of these feeders passes through the lowermost pond from which it overflows into the basin forming the terminus of the Nutbrook Canal. In its course between this point and the waterworks intake the Nutbrook receives in addition to the Mapperley and Stanley brooks, which join it, drainage water from a colliery. At one point half a mile above the waterworks intake, a privy was noted which was built over the stream in such a manner that its contents could not fail to percolate into the water.

The fields from surface drainage of which the water of the feeders of the Nutbrook is in part supplied are also in some instances manured with the contents of privies.

From the above account it will be seen that it is hardly possible to imagine a more dangerous and disgusting source of water than the Nutbrook. The water furnished by the disused coal pit at Kirk Hallam appears to be of good quality, but its quantity is limited.

The Private Wells are chiefly situate at Cotmanhay in the northern portion of the borough. They are shallow, dry-steined with bricks, in some instances liable to pollution from neighbouring midden privies and house drains, in other cases free from risk of pollution.

Sewerage.—The borough is now sewered throughout the greater part of its extent. The sewers, which have been extended and relaid from time to time, are constructed of sanitary pipes. They are ventilated by the man-hole covers, and by five or six iron ventilating shafts placed at the highest points of the system. The sewers are flushed from the manholes. Most of the sewers have a good fall, but in the neighbourhood of the river Erewash on the eastern side of the borough the sewers are rather flat, and one of the main sewers here has subsided owing, it is stated, to coal mining in the vicinity. The flow of sewage in a portion of this sewer is now in a direction contrary to that originally intended. Many complaints arise in the summer time respecting effluvia from the sewer manholes, but at the time of my visit, in February, no such nuisance was perceptible.

The sewers converge to four main outfalls. At three of these outfalls, Ives' patent tanks are provided for the treatment of the sewage by an alumino-ferric preparation with subsequent precipitation. In the case of two of these tanks which were in use at the time of my visit, namely at the central and southern outfalls, the effluent is discharged directly through a watercourse into the river Erewash. The effluent from the central outfall was very turbid and unsatisfactory, that from the southern one was of much better appearance, but caused the formation of a large amount of flocculent growth in the watercourse and in the river below the point of discharge. The northern outfall sewer is connected to an Ives' tank which is provided with two filters of fine gravel, but at the time of my visit the sewage was passing directly from the tank through a surface channel on a piece of land, which was laid down in grass, and over which the sewage passed almost unaltered into a watercourse falling into the river Erewash. The remaining outfall sewer is at the south-eastern extremity of the borough, and terminates at a sewage farm of about 40 acres in extent. At the time of my visit, however, this outfall sewer had been destroyed by excavations in a brickfield, and the sewage from it was diverted to the southern main outfall sewer.

At Hallam Fields there are about 200 dwellings which are not connected with any sewer. The liquid refuse from the dwellings passes into roughly constructed catchpits, from which the overflowing liquid passes into the highway drains, and thence into a small watercourse which falls into the Erewash.

House Drainage.—As regards the greater number of the dwellings the house drains are of glazed sanitary pipes. The inlets in many instances are, however, fitted with the old-fashioned Bell trap.

Excrement Disposal.—Of the 5,020 dwellings in the borough, 2,400 are provided with pail closets, 248 with water closets, 430 with waste-water closets, and the remainder, 1,942, are served by 971 midden privies, which are distributed so that one privy serves for two dwellings. Scavenging of pail privies is performed by the Town Council. The pails are emptied weekly into tank carts, and the material is removed direct to farms in the neighbourhood. It is delivered to the farmers free of charge, but a charge of one shilling per quarter is made for each privy and is paid by owners or occupiers. Scavenging of midden privies is performed either by the Town Council or by private owners. The scavenging is performed by the employees of the Council on receipt of notice from householders, or on complaint of nuisance. A charge of eighteenpence per load of material removed is made by the Town Council. The material removed is delivered to farmers free of charge.

There is no method in use for cleaning the pails of pail privies after emptying of their contents. The pails, which are of wood, are emptied into the tank cart in the street, and then returned directly to the closets. Midden privies are of very faulty construction ; the receptacle is of too great dimensions, frequently sunk below the ground level, and uncemented, so that liquid matters may percolate into or from the receptacle. The scavenging of these privies is performed at very infrequent intervals, often not more than twice in the year, and large accumulations of filth in them were noted at the time of my visit. At Hallam Fields most of the dwellings are provided with uncovered midden privies of very faulty construction, which are scavenged by the Stanton Ironworks Company.

Refuse Disposal.—In the case of dwellings provided with pail or water closets, receptacles, either fixed or movable, are provided in many instances for the collection of house refuse and ashes. These are emptied by the Town Council's employees, and the material removed to farms, or used for filling up holes or disused clay pits. Many dwellings of the poorer class are unprovided with receptacles for ashes and refuse, which are allowed to accumulate in heaps in corners of yards, thus causing nuisance.

Nuisances arising from keeping of animals are not so prevalent as is frequently the case in colliery districts.

Slaughter-Houses.—There are 23 slaughter-houses which are registered. Their condition is very diverse. In one instance the slaughter-house was quite dark, and its interior had a most offensive odour. The most common defects are filthiness from want of regular limewashing, defective flooring, and imperfect ventilation. The arrangements for the disposal of offal are, in most instances, satisfactory.

Cowsheds, Dairies, and Milkshops.—There are 23 persons registered as proprietors of cowsheds. Several of these cowsheds have dairies attached. There are also six persons registered as sellers of milk only. The condition of the cowsheds and dairies differs widely. One proprietor was so far enlightened as to cleanse the teats of the cows before milking ; but, in most instances, the condition of the cowsheds was very unsatisfactory. The chief defects in cowsheds consist of imperfection or absence of arrangements for drainage, overcrowding, inefficient ventilation, and filthiness from want of limewashing and cleansing. The animals in these cowsheds, in many instances, were, from neglect, plastered with filth. With one exception all the dairies which I visited were supplied with water from private wells.

Bakehouses.—The number of these is not known. Their condition is various. The flooring is, in many instances, composed of soft bricks or other unsuitable materials, the ventilation is often imperfect, and the walls dirty.

Common Lodging Houses.—There are four registered. One of these is a building which has been newly erected for the purpose of a lodging house, and is kept clean and is provided with waterclosets. The remainder are unsatisfactory ; one of them on account of the privy accommodation, which consists of a large midden sunk below the ground level, and with four privies opening into it; the others on account of the filthy condition of their interiors.

Isolation Provision.—This consists of a wooden building, which comprises four wards, each capable of containing six beds. Unfortunately when the hospital was erected no provision whatever was made for the staff, and, in consequence, two of the wards have to be used for the accommodation of the matron and nurses.

Admission to the hospital can only be obtained by payment, the usual charge being three shillings per diem; or by means of an order from the relieving officer, in which case the Guardians of the Poor refund to the Council the sum of three shillings per day as long as the patient remains. During 1898 of 37 admissions only three were persons whose friends paid for them; the remaining 34 were paid for by the Guardians. This arrangement is an unfortunate one, since in many instances sufferers are kept at home until their relatives have exhausted their means in supplying them with nourishment, and have impaired their own health by attending to them. Finally, when the patient is in the later stages of the disease, and therefore more likely to suffer from the effects of removal, the relieving officer is called in to make an order for the reception of the patient at the hospital.

Disinfecting Apparatus.—The Town Council have no apparatus for disinfecting infected bedding, clothing, etc.

(*b.*) *Prevalence of Enteric Fever at Ilkeston.*—For many years past the borough has not been free from enteric fever, although there has been comparative freedom from diphtheria and other dangerous infectious diseases. In 1881 there were 5 deaths from enteric fever; in 1882, 3; in 1883, 1: in 1884, 3; in 1885, 7; in 1886, 2; in 1887, 2; in 1888, 6; in 1889, 11; in 1890, 8; in 1891, 2; in 1892, 7. In 1893 the Infectious Disease (Notification) Act, 1889, came into force, and in this year 90 attacks of enteric fever were notified under its provisions, and 9 deaths occurred from the disease. In 1894, 73 attacks were notified and 4 deaths occurred; in 1895, 24 attacks and 4 deaths; in 1896, 80 attacks and 8 deaths; in 1897, 69 attacks and 13 deaths; in 1898, 112 attacks and 29 deaths. During the present year 8 attacks have been notified up to February 18th.

I made some inquiry concerning all the attacks which had been notified during 1897 and 1898, and in 1899 up to February 18th, and visited many of the premises at which attacks of fever had occurred. As the result of my inquiries, it appeared that the notified cases did not represent the whole of the attacks. I found that in some instances several of the children and other younger members of a household suffered from ill-defined illness for days or weeks, and only on the more pronounced illness of an elder member of the family was a medical man called in, who thereupon pronounced the illness of the adult to be enteric fever. With respect to the seasonal prevalence of the fever, accurate statistics cannot be obtained, partly owing to the fact that cases coming under the personal observation of the Medical Officer of Health are not notified to the Town Council in the manner provided for in the Infectious Disease (Notification) Act of 1889. The Council have agreed with the Medical Officer of Health not to pay him for certificates furnished under this Act; consequently, where attacks of the disease have come under his notice only, they have not been notified, and owing to the absence of information which would have been afforded by these certificates, and the absence of any private records, the dates when the disease was first found to be enteric fever cannot be definitely ascertained. However, it is noteworthy that there was no month in the years 1897 or 1898 in which notifications of enteric fever were not received, thus pointing to a more uniform distribution of the disease than is usually observed, and one not corresponding closely with the ordinary seasonal variation of the disease. An examination of whatever records were available showed that at any rate there had been no great and widespread outbreak in any limited period during the two years, and that the disease was more prevalent in the months of September, October, and November.

Owing to the absence of data no accurate statistics can be given of the age or sex distribution of the disease, or of the number of infected households. The Council have not caused the notification certificates to be copied into any register, nor have they kept a record of the age and sex of the sufferers notified to them. The certificates themselves are the only source of information available, and these were often almost illegible, and in some cases did not state the accurate address of the sufferer. The conclusion which I came to, as the result of examination of these imperfect records was, that there had been comparatively few instances of multiple attacks in households, and not many instances of special incidence of fever upon particular blocks or groups of dwellings. The fever was spread more or less over the whole of the borough, the incidence corresponding, so far as could be judged, to the density of the population. Thus of the three wards into which the borough is divided, the incidence has been numerically greatest on the Central Ward, which is the most thickly populated ; less in the South Ward, which is less thickly populated ; and least in the North Ward, which is semi-rural in character and of which the population is least in density. A return, prepared by the Medical Officer of Health, Mr. J. Willis, showed that of 90 sufferers amongst those notified in 1898, 43 lived in the Central Ward, 34 in the South Ward, and 13 in the North Ward. The prevalence of fever was not limited to any particular class of the inhabitants. The majority of the sufferers were of the working class, to which class the majority of the inhabitants belongs ; but the families of shop-keepers and persons of a superior class were also affected.

With regard to the mode in which the fever had spread, there was nothing to show that this had been by means of effluvia from the sewers, or by percolation of infected matters from the sewers into the subsoil. The wide distribution of the fever was against this explanation of its spread, and on comparing a spot map, which showed roughly the situation of infected dwellings, with a plan of the sewers of the borough, there was no special incidence in the line of any particular sewers.

On the other hand, outlying dwellings without connections to any sewer, and a block of dwellings at Little Hallam Fields which, as has been already mentioned under the heading of General Sanitary Condition of the Borough, are detached from the rest of the borough and not connected to the borough sewers, had been infected by fever. The house drains also are in all cases outside dwellings, so that although the gullies connected to them were in many instances defective, there was little risk of sewer effluvia entering dwellings.

There was nothing to show that methods of excrement disposal had any large effect in the spread of fever. In a few instances, there was undoubtedly strong suspicion that particular midden privies had become infected by the discharges from sufferers, and had led to multiple attacks in households using these particular privies, but it was impossible that any large proportion of the fever attacks could be accounted for in this way. Of 78 invaded dwellings as to which particulars as to the method of excrement disposal in use were supplied to me by Mr. J. Willis, 39 were provided with pail closets, 24 with midden privies, 10 with waste-water closets, and 5 with water-closets, numbers which are in pretty close agreement with the relative proportions in which these conveniences are in use in the borough, and which show if anything an undue incidence upon the users of waste-water closets. Residence in older dwellings the subsoil around which had become fouled by organic matters did not appear to have predisposed to enteric fever. A very large number of the attacks occurred in newly-built houses, and in some instances the first occupants of dwellings newly-erected upon an undisturbed and uncontaminated subsoil had become affected by the fever. There was no suspicion that any particular milk supply had been concerned in the dissemination of enteric fever. It was possible that personal contagion in households accounted for a certain number of multiple attacks in dwellings, but there was nothing to show that this factor could have operated upon a large scale.

It was soon seen that the water supply was the only factor which was common to all the invaded dwellings. To whatever locality the water from the mains was carried, there fever might be found. Comparison of the spot map of the borough upon which I had marked the locality of invaded dwellings with a plan of the water mains prepared for me by Mr. Kilford, the Surveyor, showed that a local pollution of the water of particular mains by in-suction of infected matters through a ball hydrant, or in other manner, would not explain the incidence of the fever, and the water mains of the town are remarkably free from dead ends in which infection might conceivably multiply under such circumstances. It was clear that the general water supply was in all probability the medium by means of which infection had been conveyed to different parts of the borough. On this supposition the invasion of dwellings at Little Hallam which were entirely cut off from the rest of the borough in every respect except that of a common water supply, the invasion of dwellings isolated in every respect except their connection to the water mains, and the small incidence of fever in the north ward, in which many of the dwellings were supplied with water from local wells, was to be explained. In this way also may be explained the remarkable freedom of dwellings at Ilkeston Junction (New Cossal), population about 1,000, which although situate in Basford Rural District is practically a part of Ilkeston, and is continuous with the most densely populated part of the borough from which it is only separated by a short bridge over the Erewash. In these dwellings, which are supplied with water from the Nottingham Corporation's Waterworks, although the general conditions under which the inhabitants live are in all respects similar to those under which the people of Ilkeston live, except in the matter of water supply, no attack of enteric fever has occurred for a number of years.

It is probable that the poison of enteric fever has seldom been absent from the Ilkeston water supply owing to its pollution by sewage from Heanor, at which place enteric fever has been prevalent for some years past, but that it has usually been present in small quantities, having entered the water service owing to imperfections in the filtering apparatus or in the method of filtration. In this manner the absence of any great outburst of enteric fever is to be explained, and its prevalence month by month with such uniformity in the borough. It is hardly necessary to seek for the sources of the enteric fever poison in the Ilkeston water looking to the manifold pollutions to which this water supply is exposed. In fact it was not necessary to go any farther than the waterworks for a source of pollution of the water. At the time of my visit, work was in progress on the waterworks site for the sinking of a shaft to obtain water, and I noted that the side of the reservoir was used by some of the workmen for purposes of defœcation, so that a shower of rain might have carried fœcal material into the water. The principal source of infection has probably been at Heanor, where the effluent from the sewage farm at Commonside and the liquid refuse from a portion of Marlpole have been discharged into the water supplying the Nutbrook Canal and the Nutbrook, from which the Ilkeston water is chiefly derived. I found that there had been a considerable incidence of enteric fever in a row of dwellings at Marlpole in the Heanor Urban District known as Munday's Row, both in the years 1897 and 1898. The liquid refuse from these dwellings escapes without any purification into the Nutbrook Canal, and thence into the Ilkeston water. Marlpole and Heanor are only 2 and 2½ miles distant from Ilkeston respectively, and their inhabitants are in constant communication with Ilkeston, many of them going to work in the borough. It is probable that there has been a more or less constant transmission of enteric fever between Heanor and Marlpole and Ilkeston, the disease being contracted at Ilkeston, conveyed to Heanor or Marlpole, and the infection thence discharged into the water supplied by the Ilkeston Town Council.

(*c*) *Measures taken by the Town Council for the prevention of Enteric Fever.*—Since the summer of 1897, a galvanized iron pail with an airtight cover has been supplied by the council to every dwelling invaded by enteric fever. These pails have contained some carbolised powder, have been removed daily and their contents mixed with quick lime and buried in the earth. The householders, in the case of invaded dwellings, have been instructed to place all the excreta from sufferers in these pails, and a card of printed instructions containing information for the prevention of infection has been supplied to them. Disinfectants have also been supplied to invaded households, midden privies pertaining to invaded houses have been emptied and cleansed, and gross sanitary defects found have been remedied in some instances. In some instances dwellings have been "fumigated" with carbolic acid by the Inspector of Nuisances, but in the absence of any disinfecting apparatus the cleansing of infected clothing and bedding has been performed by householders only. No record has been kept of the sanitary circumstances of the invaded dwellings except where gross sanitary defects existed. The Inspector of Nuisances holds the offices of market inspector, inspector of canal boats, inspector of common lodging houses, and inspector of cowsheds and dairies. He also superintends the scavenging of the borough, and the removal of patients to the isolation hospital. Owing to these numerous duties, he has little time for the performance of his work as regards nuisances or for systematic inspection of his district. He is an elderly man, and has never sought to procure a certificate of proficiency in sanitary work.

In 1893 I visited Ilkeston in consequence of an outbreak of cholera there;* I made an inspection of the district, and subsequently conferred with the Town Council, and submitted to them certain recommendations for the prevention of cholera or other dangerous infectious diseases. These recommendations included among others the provision of a fresh source of water supply without delay, improvements in sewerage and house drainage, and in excrement disposal, and the more thorough carrying out of the work of inspection of nuisances in the Borough.

In July, 1897, the Town Council obtained the Board's sanction to the borrowing of £1,800 for works of water supply. In 1898, they obtained a private Act of Parliament to enable them to carry out works of water-supply. A bore-hole has been made on the site of the present waterworks at Kirk Hallam, a shaft has been partially completed, and, I am informed, that altogether about £10,000 has been expended, but so far without entirely satisfactory results.

II. ENTERIC FEVER IN THE URBAN DISTRICT OF HEANOR.

(*a*). *General sanitary condition of the district.*—The Urban District of Heanor is co-extensive with the parish of Heanor, and is situate in the county of Derby; it has an area of 1,597 acres. The district is separated from the borough of Ilkeston by the parish of Shipley, which is in the Basford Rural District. The population in 1871 consisted of 4,888 persons only; in 1881 it consisted of 6,822 persons; in 1891 of 9,779 persons, and the population in the middle of 1898 was estimated at 11,500 persons. In April, 1896, there were 2,286 dwellings in the district. The population has increased rapidly, and the inhabitants are engaged in coal-mining, brick making, hosiery, and lace manufacture. There is very little poverty in the district, owing to the abundance of employment for both sexes. The population consists almost entirely of the working class.

The district includes the town of Heanor, which occupies an almost central position, together with the outlying places known as Langley Mill, Langley, and Marlpool. These last-named places have arisen on the site of previously existing hamlets, and by extension of building operations have become almost continuous with Heanor and with each other. The greater portion of the district is high-lying, the exception being Langley Mill, which borders on the river Erewash. Dwellings are amply exposed to sunlight, and there is a free circulation of air everywhere. The subsoil consists of drift clay and gravel overlying the Coal Measures, and the surface of the district is undulating in character.

Condition of Dwellings.—Most of the dwellings are newly-built, and have a sufficiency of open space in front and at the rear. Many have a good sized piece of garden in the rear, and the streets and roads are wide and well kept. Yards pertaining to dwellings are however generally unpaved and allow of soakage of foul liquid matters, which may chance to be thrown on their surface, into the soil. The subsoil in the neighbourhood of dwellings is also frequently fouled by soakage from cesspit privies, from filthy rain water tanks, and from collections of household refuse and filth.

Water Supply.—This is derived from five different sources. (1) A deep well at Langley, from which water is pumped to two filtering tanks. The filters are of Trent sand, and the filtration is necessary, in order to remove iron salts which are held in suspension by the water. From the filters the water flows by gravitation to a sump, from which it is pumped into a reservoir at Heanor. (2) A deep well at Commonside Heanor; the water is pumped from this well direct to the reservoir without filtration. (3) Water pumped by a Colliery Company from outside the casing of the shaft of Bailey Brook Colliery, which is close to Heanor. This water is delivered directly to the reservoir without filtration. These sources of supply are under the control of the District Council. The reservoir at Commonside to which all the water from the before-mentioned sources is pumped is of 250,000 gallons capacity, and from it the various parts of the district are supplied by gravitation. At the present time the total quantity of water which can be obtained from these sources amounts to 133,000 gallons per day, and it is calculated that at least 500,000 gallons per day are requisite for the supply of the district. (4) Private wells, of which there are a large number in the district. These wells are shallow in most instances; they are dry-steined with bricks, and are fitted with pumps or are used as draw-wells. In the case of a very large number, the surroundings of the well are such that the water in it is liable to pollution. Sources of such pollution are cesspit privies, which are constructed of brick, uncemented, and sunk below the ground level; midden privies which are sunk below the ground level and allow of percolation from them into the subsoil; and defective house drains in the vicinity of the well, allowing of escape of their contents into the surrounding soil. (5) Tanks for collecting rainwater: these are largely used as a source of water supply, and of late the District Council have insisted on their provision for all new dwellings, owing to the very scanty supply furnished by the public waterworks. In many instances these tanks are constructed of brickwork, and are uncemented, so that percolation of liquid matters from the surrounding soil into them cannot fail at times to occur. They are liable to the same sources of pollution as the private wells, with the additional danger which arises from the fact that they are connected to the sewers by overflow pipes, so that effluvia from the sewers obtain a ready entry to them. They are also especially liable to pollution from the surface, owing to their being fitted with loose covers, which are flush with the surface of the ground in many instances.

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* *See* Report on cholera in England in 1893 with Introduction by the Medical Officer to the Local Government Board.

With respect to the quality of the water supplied to the district by the public water works, there is no reason to suspect that it is liable to pollution. No recent analysis of it is, however, available.

With respect to the quantity of water supplied by these waterworks, the deficiency in this respect is very great. At the present time the water is only allowed to flow into the mains twice in the week, and in the summer time the water has only been allowed to flow into the mains once a week. As a result there has been a severe water famine in the district, even the inhabitants of a superior class have not had sufficient water for ordinary purposes of ablution in the summer time. In the summer season there is occasionally not sufficient head of water to carry it to the higher parts of the district, and water has been conveyed to these places in carts by the Council. There has been no water available for flushing drains, sewers, or water-closets, and many sanitary improvements are at a standstill in consequence.

Sewerage.—There are sewers in all parts of the district, but owing to the undulating character of the surface it has been necessary to convey the sewage to a number of different outfalls. The sewers are of glazed sanitary pipes, but there is no provision for their ventilation apart from the manhole covers, nor can they be flushed except by pipes from water hydrants. The sewers at Heanor converge to two outfalls, one at Commonside, the other at Woodend. At both places the sewage passes through a few surface channels and pits on plots of land in which pits some deposit of solid matters takes place, but the greater part of the sewage passes unaltered into adjoining water-courses. The sewage from Langley Mill is discharged directly into the river Erewash without purification. Sewage from a portion of Marlpole, after passing through a settling tank, is dealt with on land by a farmer. At Langley and a portion of Marlpole sewage is discharged into water-courses. Several of the water-courses which are thus polluted by sewage from this district serve as sources of water for the Ilkeston Public Waterworks.*

House Drainage.—The condition of the house drains differs in different parts of the district. In the newly-built dwellings proper house drains exist, with suitable trap gullies. In the case of older dwellings house drainage is very defective, the drains consisting of rubble, or of agricultural pipes, with small brick or stone catchpits in place of gullies. A few dwellings are without house drains.

Excrement Disposal.—This is effected by cesspit privies and midden privies. There are also a few water-closets in the district and a small number of pail privies. The cesspit privies are provided with brick receptacles placed below the ground level, and covered with boards or with slabs of stone. They are not cemented as a rule, and allow of escape of their contents into the surrounding soil. Frequently the cesspits are found to be overflowing, and since they are frequently in close proximity to dwellings, they are a source of dangerous nuisance. Midden privies, in many instances, are of old-fashioned and objectionable form, with receptacles sunk below the ground level, and allowing percolation from them of their contents into the surrounding soil, from want of impervious lining. Scavenging of privies is performed by the employes of the Council. There is no regular system of scavenging; it is done at the request of householders, or on complaint of nuisance. Usually privies, both cesspit and midden privies, are emptied twice in the year. The contents of privies are given to farmers for use upon their land. I noted large accumulations of filth in midden privies, in many instances, during my inspection of the district. The pail privies are emptied once a week by a farmer, who removes the contents to his farm.

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* *See* page 8 of this Report.

Refuse Disposal.—In the case of dwellings provided with cesspit privies, pail privies, and water-closets, refuse is collected in ashpits, in movable receptacles, or in corners of yards and gardens. Refuse is removed by the Council's employees to a tip at Langley.

Nuisances arising from the keeping of animals.—In many parts of the district, pigs are kept in proximity to dwellings, and are a source of much nuisance.

Slaughter Houses.—There are 17 of these in the district which are registered. They are mostly in satisfactory condition, except as respects flooring which in some instances is very defective and of unsuitable materials.

Cowsheds and Dairies.—There are 49 registered owners of cowsheds and purveyors of milk. The condition of cowsheds is very unsatisfactory in many instances owing to overcrowding, defective drainage, and general filthiness.

Bakehouses.—There are 10 of these, which are not registered. Their condition is fairly good, but their water supply is in some instances very unsatisfactory.

Common Lodging Houses.—There are three registered. Their condition is fairly good as regards cleanliness, but the privy accommodation in all instances is most unsatisfactory. In one instance a filthy cesspit privy only was provided, in the case of the others, filthy midden privies of most objectionable construction were in use.

Isolation Provision.—The council have a small old-fashioned cottage which is situate near Heanor in an out of the way spot. This was purchased for the reception of cases of small-pox when an outbreak of this disease was threatening. Three small rooms are available for the reception of patients. In two or three instances, enteric fever patients who were in circumstances of great destitution, or whose surroundings were such as to conduce to a ready spread of the infection, have been temporarily accommodated in this building.

Disinfecting Apparatus.—The council have no apparatus for the disinfection of infected things.

(*b*) *Prevalence of Enteric Fever in the Heanor Urban District.*—For many years past the district has not been free from enteric fever. In 1888, three deaths occurred from this disease, in 1889, three; in 1890, the Infectious Disease (Notification) Act of 1889 came into force in the district, and in that year seven attacks were notified and one death. In 1891, 39 attacks and eight deaths; in 1892, seven attacks and three deaths; in 1893, 32 attacks and seven deaths; in 1894, 20 attacks and two deaths; in 1895, 26 attacks and four deaths; in 1896, 20 attacks and four deaths; in 1897, 52 attacks and 12 deaths, and in 1898, 24 attacks and five deaths. Three attacks have already been notified in 1899. The deaths from diarrhœa in 1897 and 1898 were 22 and 24 respectively.

I made some inquiries concerning the attacks notified in 1897, 1898, and 1899, and found that the disease had for the most part recurred from year to year in certain streets or collections of dwellings in parts of the district widely separated one from another. Such infected areas are, Munday's Row, Marlpole; Ray Street, Heanor; Station Road, Langley Mill; Breach Road, Marlpole; Burnt House Road, Heanor; and Milnhay Lane, Langley Mill.

As to the method in which the infection of enteric fever had spread in these localities, in some instances there was strong reason to suspect that certain wells had become infected by the fever poison, in other instances it appeared highly probable that the poison had multiplied in infected sewers and house drains, and from these had spread through leakage of infected matters from them into the soil in the neighbourhood of dwellings. Such a mode of dissemination would be greatly favoured by the inefficient flushing of drains and sewers, owing to the scanty supply of water in the district. But the multiplicity of unwholesome conditions in the district is so great that it is almost impossible to come to a definite conclusion as to the way in which the fever was spread. In 1897, there was a strong suspicion that a certain milk supply was concerned in spreading the fever, and a special report on the occurrence was prepared by Mr. W. H. Turton, the Medical Officer of Health. In this outbreak, of 36 attacks of enteric fever which were notified between September 27th and October 23rd, it was found that 31 of the sufferers had occasionally at least taken milk from a particular milk seller. A lad employed by this milk seller, and who was engaged in delivering the milk and in washing the churns and cans, was suffering during the middle of September from illness. On September 27th he was notified as attacked by enteric fever. Whilst suffering from the earlier symptoms of this illness, he had been engaged in his usual duties until prostration compelled him to take to his bed. On October 5th, the proprietor of the business was himself attacked by enteric fever. The milk purveyed from this dairy was received from a particular farmer, and so far as was known the customers of another milk seller whom this farmer also supplied were unaffected by fever. On inquiry I found that the sufferers during the outbreak in question had consumed milk from a number of different sources in addition to the incriminated one, and that the total number of customers supplied from the incriminated source was at least 100. The water with which the churns and cans were washed is stated to have been always obtained from the public supply through a tap connected to a main, but there is also a draw-well upon the premises which is liable to pollution by surface washings from the garden in which it is situate. Many of the sufferers by this outbreak were living in localities in which enteric fever has recurred from year to year; for instance eight of them lived in Munday's Row, Marlpole; four in Ray Street, Heanor; and four in Breach Road, Marlpole; localities which have been before mentioned as especially liable to enteric fever. The circumstances under which the sufferers were living also were such as to favour the spread of enteric fever, and in fact considering the unwholesome conditions prevalent in the district it is surprising that enteric fever is not even more common. It was also possible that some of the sufferers had contracted this infection at Ilkeston, with which place as before mentioned the inhabitants of the Heanor District are in constant communication.

(*c*). *Measures taken by the Urban Council for the prevention of the spread of Enteric Fever.*—As in the case of Ilkeston, galvanised iron pails have been provided for the reception of infected excreta. These pails have contained a quantity of chloride of lime in powder, and their contents, after removal by the Council's employes, have been buried in the earth. Disinfectants have been supplied to householders, and privies pertaining to infected households have been emptied. Disinfection of dwellings has been in some instances performed by fumigation with sulphur, under the direction of the Inspector of Nuisances, in other cases it has been left to householders.

In 1894 Dr. Maclean Wilson, at that time one of the Board's Inspectors, visited Heanor for the purposes of the Inland Cholera Survey, inspected the district, conferred with the Urban Council, and furnished them with certain written recommendations for the improvement of the sanitary condition of the district, and for dealing with infectious diseases. These recommendations related to the water supply, to the provision of suitable accommodation for the isolation of infectious diseases, to improvements needed in matters of excrement and refuse disposal, and to house drainage. At the present time there are three Ives' tanks in course of construction, for dealing with the sewage of Heanor, Langley Mill, and Langley, by precipitation with subsequent filtration or irrigation on land. The Council also in August 1897 obtained the sanction of the Board to the borrowing of £2,000 for works of water supply. A borehole has been made at Smalley, about three miles distant from Heanor, and the work of sinking a shaft has been commenced, but has come to a standstill owing to failure of the contractors to carry out the work.

III. ENTERIC FEVER AT TROWELL, COSSAL, AND SHIPLEY.

So far as is known during the last two years there has been no enteric fever at any of these places.

The parishes of Trowell and Cossal are essentially rural in character, but comprise aggregations of dwellings of an urban character which are situate on the borders of the Borough of Ilkeston. These aggregations of dwellings are known as Ilkeston Junction or New Cossal, and Trowell Junction. At Ilkeston Junction there is a population of about 1,000 persons, the population of the whole parish of Cossal estimated to the middle of 1898 consisting of 1,200 persons. At Trowell Junction there is a population of about 250 persons, the population of the whole parish of Trowell estimated to the middle of 1898 consisting of 4,009 persons. The population of Shipley parish estimated to the same period is 664 persons. In this parish the population is very scattered, and there are no collections of dwellings of an urban character. The condition of dwellings is for the most part good in these places.

The water supply of Ilkeston Junction is from the Nottingham Corporation's waterworks, that of Trowell Junction is from private wells which are liable to pollution by soakage from midden privies and defective house drains. At Shipley a number of dwellings are supplied with water pumped from outside the casing of the shaft of the Woodside coal pit.

Sewerage is wanting at Trowell Junction where liquid refuse passes directly into watercourses, and it is very defective at Ilkeston Junction where imperfectly constructed sewers discharge into watercourses giving rise to great nuisance. At Shipley there are two collections of dwellings which are drained to settling tanks, the liquid matters passing thence through filters of coal which are provided by the Woodside Colliery, and which appear to be well managed. House drainage is defective both at Ilkeston Junction and at Trowell Junction. Excrement disposal is effected by midden privies, which in many cases are of very faulty construction and allow of percolation of their contents into the surrounding soil. There are a few pail privies and a few water-closets at Ilkeston Junction. Scavenging at Ilkeston Junction is performed by farmers who contract with the Basford Rural District Council for this purpose. There is no systematic scavenging at regular intervals. Scavenging in the remaining parishes is left to private owners or to householders. There are no slaughter houses, common lodging houses, or bakehouses at these places. The hospital at Bulwell belonging to the Basford Rural District Council, which has been built in accordance with the Board's requirements, is available for isolation purposes. A disinfecting apparatus has been also provided by the Rural Council.

S. W. WHEATON.

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